REPORT ON A SENSORY PROGRAMME FOR PATIENTS WITH SENSORY DEFICITS*

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Sensation and movement are seen to be linked together and sensation is often used as a means of improving movement function. The sensory programme is an attempt to focus on the sensory side of sensory/motor deficits, and involves the stimulation of touch, pressure, temperature and joint receptors, and also muscle spindles, in an effort to 're-educate' sensation. The programme described was tested on twenty patients. Although there was some improvement in sensation, motor improvement was more apparent and occurred earlier in treatment, some patients showing marked improvement in motor function after a relatively long (four to six months) period. The programme is seen as a useful technique to use in combination with other forms of treatment for patients with decreased sensation. It has lately been used for patients with hypersensitivity with some encouraging results.

This paper is a report of a small study on the effects of a programme designed to increase sensory input or to stimulate sensation in patients where there is some sensory dysfunction. An outline of the philosophical basis of the programme and the concepts involved in this type of sensory stimulation will be given. The results of the study that was undertaken will be outlined.

Philosophical basis underlying the programme

To stress the importance of sensation in the co-ordination of normal movement almost seems to be stating the obvious. A brief glance into any book or article on the control of movement, motor learning or perceptual motor function shows that this concept is of prime importance. For example, Fisher (1967, p. 515) states that:

> "For motor co-ordination, what happens in the periphery to proprioceptors and exteroceptors can be at least as important as the intrinsic organisation of the Central Nervous System."

Rood (as quoted by Stockmeyer, 1967) suggests that associated with normal movement there are stimuli present prior to responses and there are those which provide feedback during responses.

Montagu (1971, p. 7) states that, "The brain must receive sensory feedback from the skin in order to make such adjustments as may be called on in response to the information received."

Ayres (1974) suggests that there are two basic concepts related to the importance of sensation to movement. Firstly that reflex movements, which by definition are elicited by sensory stimuli, are the foundation for voluntary movement, and secondly that ongoing motor learning and behaviour are strongly influenced by, if not dependant on, incoming sensation.

Wyke (1975) puts a slightly different slant on this concept when he suggests that it is with his muscles that man ultimately establishes himself as a social organism because it is muscles that are the instruments by which man communicates to others and explores his environment. Using muscles as tools the brain explores the environment by moving the body, armed with sensory receptors, through the environment.

These quotations from a neurologist, an anthropologist, a neurophysiologist, an occupational therapist and a physiotherapist are given to show the wide area of agreement in this important field of sensation and movement. Therapeutically physiotherapists seem to use what can be called a sensory/motor/sensory chain to try and achieve, in treatment, the normal interaction with the environment which is called purposeful movement. This purposeful movement is surely the aim of all therapeutic procedures. In many approaches to treatment and in many treatment techniques sensation is used as a means of increasing motor output. For example, Ayres uses sensation and multiple stimuli for perceptual motor dysfunction; Knott and Voss and Rood use proprioceptive stimuli as well as cutaneous stimuli in their approaches to treatment. The Bobaths also use both

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proprioceptive and tactile stimuli to improve motor function. It seems that in many of the therapeutic procedures we use, sensation is used as a tool to increase or improve motor function. In other words sensation is assumed to be present or available for use. When however the sensory side is defective or deficient, the use of sensation in improving movement cannot be as effective and its use can thus be questioned.

To summarise thus far, sensation and movement are linked together and sensation is used as a means of improving movement function. When sensation is deficient or defective, those therapeutic procedures which rely on sensation as a stimulus for movement responses cannot logically be as effective. The question of a logical and well thought out treatment programme for patients with sensory problems thus reveals itself as a conceptual as well as an actual treatment problem.

The usual treatment approach to the problem of sensory deficit or dysfunction is to employ other sensory modalities, particularly vision, to compensate for the loss of proprioceptive and cutaneous sensation, and to continue using methods of treatment using sensory input in the hope that they may be effective. What does not seem to be done by many physiotherapists is to deliberately try and do something about the loss of sensation itself. We do not talk about 're-educating' sensation.

The sensory programme is an attempt to focus on or treat the sensory side of sensory/motor deficits. Two articles in the American Journal of Occupational Therapy were found in which some sort of sensory retraining was attempted in adult hemiplegic patients. The earlier study (Vinograd, Taylor and Grossman, 1962) used repeated sensory testing to improve sensation and the later study (Fox, 1964) added five minutes pressure and cutaneous stimulation (touch) to the repetitive testing. Both studies were concerned with the improvement of hand function and stereognosis in particular and both studies reported improvement in the tests. I have been unable to find anything of a similar nature reported in any physiotherapy journals. We seem to be missing out on an important aspect of treatment, that is the deliberate re-education of sensation.

Concepts involved in the programme

The sensory programme involves stimulation of touch, pressure, temperature and joint receptors as well as muscle spindles, the different sensations being stimulated one after the other in a 'burst' of sensation coming into the central nervous system over different pathways in a period of six minutes.

In developing and continuing to develop the programme the following concepts have been formulated.

Firstly, and this is the key to the whole programme, if sensation is to be regained or 're-educated', a deliberate attempt at activating sensation must be made. The patient must be given the opportunity to experience and relearn what different sensations are like and how they 'feel'.

Secondly, receptors need to be stimulated to ensure their normal function. Wyke (1975) states that the maturation of the corpuscular mechanoreceptors in the various tissues of the body, especially the skin and capsules of the synovial joints is determined by the mechanical stresses to which tissues are exposed, and further that immobility of whole or part of the body in early postnatal (or later) life is a serious impediment to voluntary activity based on kinaesthetic inputs. Thus in order to try and re-educate sensation, the sensory receptors must be stimulated.

Thirdly, coarse stimulation needs to precede fine stimulation. Clinically, coarse or generalised sensation returns before fine or critical sensation. Montagu (1971) suggests that returning sensation, experienced first in a very general way, is gradually more localised and more critical so that one can eventually localise it exactly. In treatment, coarse or generalised stimulation is used to try and activate sensory receptors rather than fine or critical sensation.

Fourthly, and this concept was derived from the work of Jean Ayres, in trying to get sensation back into a part, multiple stimuli, or the activation of as many different sensory receptors as possible may aid in sensory return. In treatment, the sensations of touch, pressure and temperature and the activation of joint receptors and muscle spindles are all included in the programme.

An initial study was set up to find out a little about means of testing, the sequence, time and modality of the sensory stimulation programme. From this initial trial a further study was undertaken and it is this study that will be reported in some detail.

THE STUDY

Patients were chosen for the programme from neurological patients at a single rehabilitation centre who presented with sensory/motor dysfunction. The patients were those who were assigned to students during student clinical placements. There were 9 females and 11 males in the study. These patients had come to the centre from other hospitals, and the length of time between start of physiotherapy treatment and commencement of the programme was from one month to six months. There were 12 left hemiplegic patients, 5 with right hemiplegia and 3 others. The testing programme was terminated after six weeks, provided the

patient had not been discharged or other organisational variables had not intervened.

Testing procedures

Sensory testing and recording

A sensory assessment was carried out prior to commencement of the programme and at weekly intervals thereafter. Touch was tested by the examiner's finger being held for two seconds on a part. The patient was then asked to point to the part touched. Pressure was tested in a similar manner but the finger pressure was sufficient to indent the skin. Sharp and blunt was tested with a pin in the usual manner. Coarse joint position sense was tested by asking the patient whether the joint was straight or bent (movement through 40 or more degrees). Fine joint position sense was tested by asking the patient if the joint was more straight or bent (movement through 10 or less degrees).

Sensory improvement was recorded in three separate categories.

Category 1: *No improvement* – no change in any of the 5 tests.

Category 2: *Slight improvement* – some change in 1 or 2 of the 5 tests.

Category 3: *Marked improvement* – some change in 3 or more of the 5 tests.

Improvement was judged on greater accuracy, that is less errors, less time to produce accurate statements and some statements being made in previous areas of no response (i.e. no reported sensation).

Motor testing and recording

Motor performance was recorded initially and when the programme terminated. Three categories were used, each with five or six levels.

Category A. Gross motor abilities

1. Roll with physiotherapist's assistance.
2. Roll unaided.
3. Sit unsupported with physiotherapist's assistance.
4. Sit unaided.
5. Stand with physiotherapist's assistance.
6. Stand unaided (by physiotherapist).

Category B. Walking abilities

1. Walk (in parallel bars) with physiotherapist's assistance.
2. Walk in parallel bars unaided (by physiotherapist).
3. Walk with crutch and caliper (brace).
4. Walk with stick and caliper.
5. Walk with stick.
6. Walk without aids.

Category C. Fine motor abilities (upper extremity function)

1. No spontaneous movement.
2. Gross movement upper extremity.
3. Gross movement hand.
4. Individual finger movement.
5. Normal.

The sensory stimulation programme

The programme consisted of one minute each of brisk icing, brisk clapping, approximation or pounding through the long axis of the bone, vibration and two minutes brisk towelling with a cotton (terry) towel. A general treatment programme was then carried out immediately after the stimulation.

The area stimulated was the area nearest to that of normal sensation, linking the area of sensation to that of sensory impairment. The entire surface of the limb or part was stimulated and the part of the limb nearest the normal sensation received the greatest amount of sensory stimulus. For example, if the lower extremity was being stimulated, and there was disturbed sensation in the thigh with no sensation in the lower leg, the thigh received the greatest amount of stimulation. If there was an area of increased tone, for example, over biceps brachii, this was given minimal stimulation and other areas were stimulated more. The patient was instructed to concentrate on the stimuli and try and 'feel' what was happening.

RESULTS

Sensation

It was found that when the patients were classified into categories of sensory improvement, the majority showed only slight improvement.

The results are as follows:

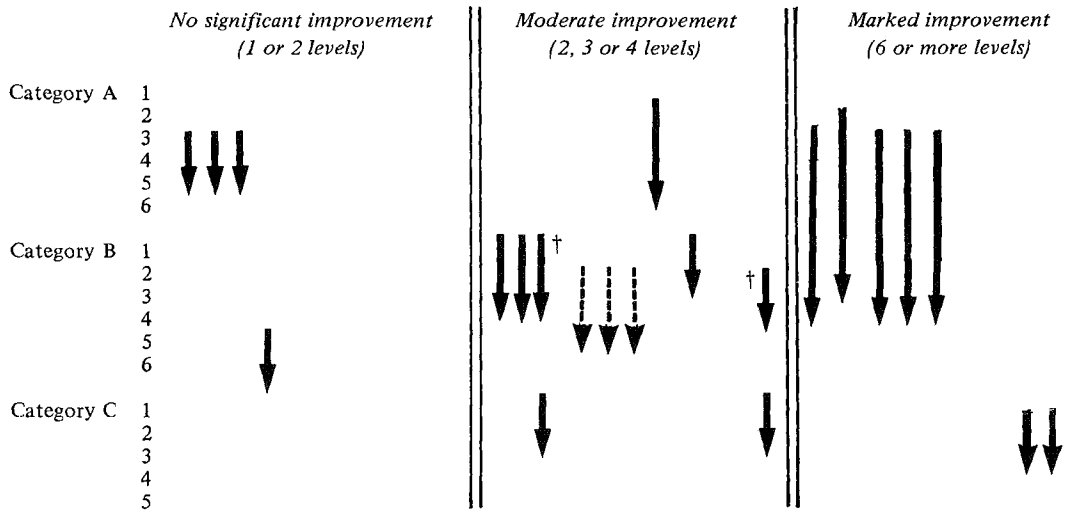
		Number of Patients	*% of Patients*
Sensation –	Category 1	4	20%
	Category 2	10	50%
	Category 3	6	30%

The patients who showed no sensory improvement also showed no significant motor improvement. The other patients showed varying amounts of improvement. For clarity of presentation the patients have been grouped into those showing no improvement, those showing moderate improvement and those showing marked improvement. The improvement of these patients through the various levels shown in Table I.

DISCUSSION

At this stage, which is only a descriptive and identifying one and not a comparative clinical trial, all that can be advanced are tentative suppositions and thoughts. Generally on the group

TABLE 1: INDIVIDUAL PATIENTS MOTOR IMPROVEMENT



of patients in the study, there was improvement in both sensory and motor categories in more than half the patients over a period of up to six weeks. The majority of the patients had been on treatment for some time before the programme commenced. Those therapists who were involved in the trial and those using the programme feel that the programme gives something new and potentially effective to try in patients with sensory/motor dysfunction, particularly when treatment seems to be at a standstill after a considerable period of time. Until recently when patients have been put on the programme fairly early (after one month) of treatment, it was the longer term patients who were started in the programme. The seven patients who fall into the marked improvement category were among the longer term patients.

Of the seven, five improved through six or more levels and two improved in the fine motor levels. The two who improved in the latter had been on treatment for four months and had subjectively reached a plateau in treatment. In two weeks there was improvement which started almost immediately with signs of motor improvement. Four of the others had a similarly long (from 3 to 4 months) treatment period before the start of the programme, and the fifth was a patient who had had a cerebrovascular accident in adolescence and had been on treatment at this time for one month before the programme was started.

All patients showed motor improvement early in the programme. Taking these patients as indicators, the following points can be made.

Firstly, all patients had been on treatment or had sustained the initial brain damage for over three months and had subjectively plateaued.

Secondly, improvement in motor ability was seen almost immediately after the start of the programme and continued improvement was noted.

Thirdly, the sensory improvement was not as marked as the motor improvement. Although there were some sensory gains, these did not appear as early as the motor improvement.

Fourthly, if there was no significant improvement in either sensation or motor performance by six weeks, it was unlikely that there would be any marked or moderate improvement.

There are of course many problems in a study of this sort; many questions asked and no answers given. For example, is the lack of significant sensory improvement as tested real or are the procedures used to test sensation not accurate enough to pick up changes? Was the improvement found due to the programme or was it the result of a score of other variables, for example, suggestion, attention paid to desensitised parts, the variability of sensory thresholds or the fact that patients were taking part in a clinical study? If the improvement is due even in part to the programme, is it the total programme or only parts of it that make the difference in patient response? Why did some patients improve while others showed no improvement? What are the key factors that may be able to predict success with the programme?

Unfortunately there has been no opportunity to continue with the study to date – again due to a host of variables, the main one being that precious commodity time! The programme is continuing to be used at Coorabel Rehabilitation Centre where it was started, and staff report that they are finding it a helpful therapeutic tool with patients who have sensory/motor problems. It is also being used at the Queen Elizabeth II Rehabilitation Centre and at various other hospitals in Sydney as it becomes a little more widely known.

The programme is now starting to 'hybridize' and in the absence of further data, some case studies showing how it is being used now, may give some indication as to the current use of the programme and the concepts from the programme. I feel that the most successful use of the programme is in those patients who have 'good' movement hampered by lack of sensation although patients with more severe motor and sensory problems are reported as improving. The new developments seem to be in the area of patients with hypersensitivity and also with patients having other types of disease processes – for example, transverse myelitis and Guillain-Barre syndrome.

Case studies

A patient with post herpetic neuralgia with a C4 dermatome distribution on the right side was referred for physiotherapy after a period of 18 months. After a period of one week, a modified sensory programme was started (no vibration); after a further week, the patient reported an improvement in his neuralgia, in fact, having his first full night's sleep, and after a further week his neuralgia was reported as "almost better".

Another patient with an ulnar nerve lesion and a hypersensitive hand showed a similar quick pattern of improvement after three weeks on the programme, and in this case it was three years after the initial injury.

An interesting pattern was found in a young head injury patient who had good movement but a neglected left side presumably because of decreased sensation. The problem was most noticeable around the shoulder girdle region which was carried in a depressed and retracted manner despite good movement. He started the programme about two months after the head injury and improved considerably in both sensation and motor function. However while getting recovery, he seemed to go through a period of hypersensitivity to ice stimulation only, which diminished as sensation returned to a more normal level. During the period when he was hypersensitive the use of ice was decreased to tolerance level and then increased as tolerance improved. This dislike or hypersensitivity has been found in other patients and can show itself with any of the types of stimulation. Conversely it has been found that some patients prefer one or two forms of stimulation over the others. When this occurs, the preferred stimulation is increased and the disliked stimulation is decreased.

CONCLUSION

In presenting some of the concepts, ideas and patient results that have been formulated and observed during the time the programme has been used, it is hoped that interest will be stimulated in using this way of approaching patients with sensory dysfunction. It does not offer a definitive answer to the treatment of patients with sensory/motor problems. It does however give a simple, easy to manage programme which may be an effective and helpful treatment technique to use in combination with other forms of treatment when confronted with patients with problems of sensation. At the moment it is being used with patients who have decreased sensation and those who have hypersensitivity problems.

It is obvious that much more work needs to be undertaken in this area before any definite statements can be made. However to highlight and summarise some of the findings and observations so far:

- The programme is an attempt to deliberately try and re-educate or improve sensation.
- It is being used at present with patients with hypersensitivity and also with patients with decreased sensation.
- It seems that improvement, when it occurs, is seen to start fairly soon after the commencement of the programme and is generally more obvious on the motor side than on the sensory side.
- Some patients exhibit either a preference for one or more types of stimuli or a hypersensitivity to one or more types of stimuli. In these cases, the response of the patient is noted and more time and attention is given to preferred stimuli.

The importance of sensation for motor control and the importance of considering sensation as a separate entity and as a prerequisite for normal movement cannot be underestimated.

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